FACULTY OF BIOSCIENCE ENGINEERING

Extrapolation of Zinc Toxicity from Individuals to Communities in three *Daphnia* species

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Context

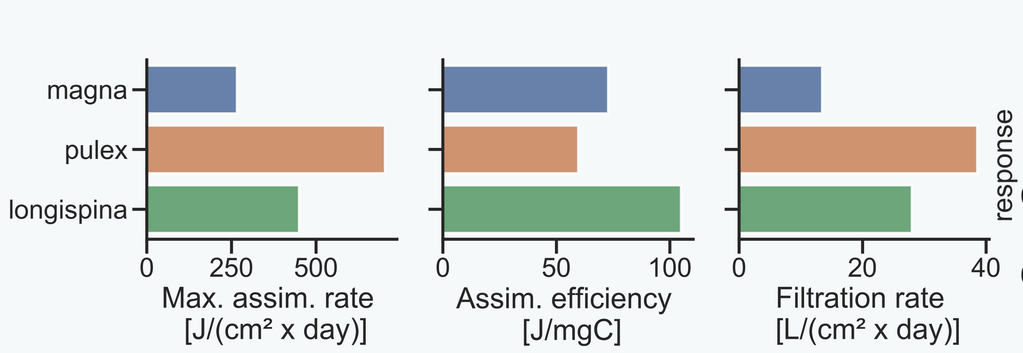
Standard tests vs **Protection goals**

single species vs populations, communities, ecosystems

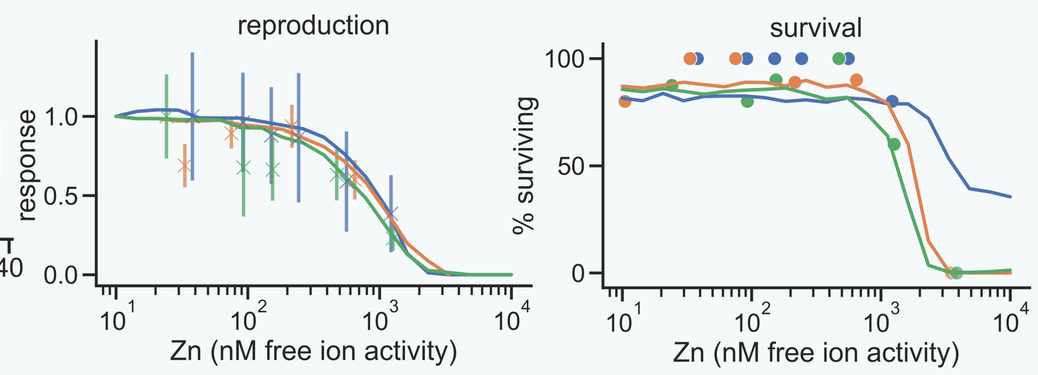
abundant food vs variable environmental conditions

Modelling exercise
Predict responses of *Daphnia* communities to Zinc with Dynamic Energy Budgets (DEB) + Individual-based modelling

Model calibration

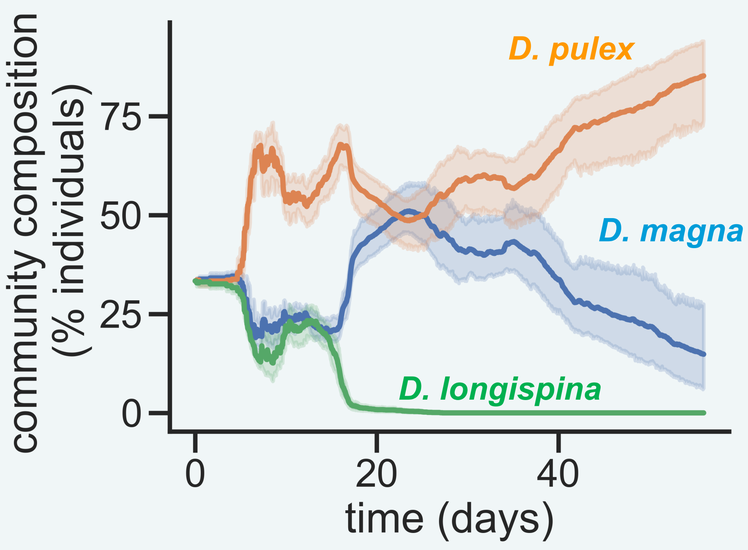


Inter-species variability in estimated DEB parameters



Fitted and observed 21d responses to Zinc of *Daphnia pulex*, *magna* and *longispina*

Predicted species interactions



Competitive ability:

***D. pulex* > *D. magna* >**

D. longispina

- Convergence towards monoculture
- All binary interactions **competition (-/-)** or **amensalism (-/0)**

Binary **per-capita interaction** coefficients

$$\alpha_{i,j} = -\frac{N_i^* - K_i}{N_j^*}$$

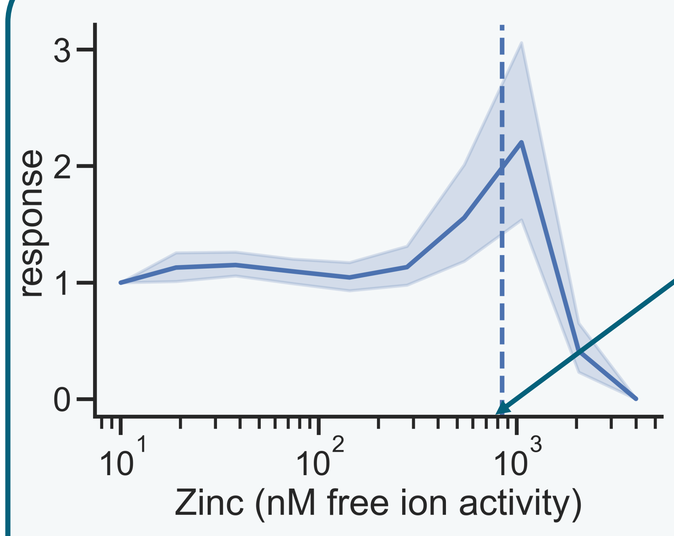
with N_i^* = equilibrium density of species i (rows)

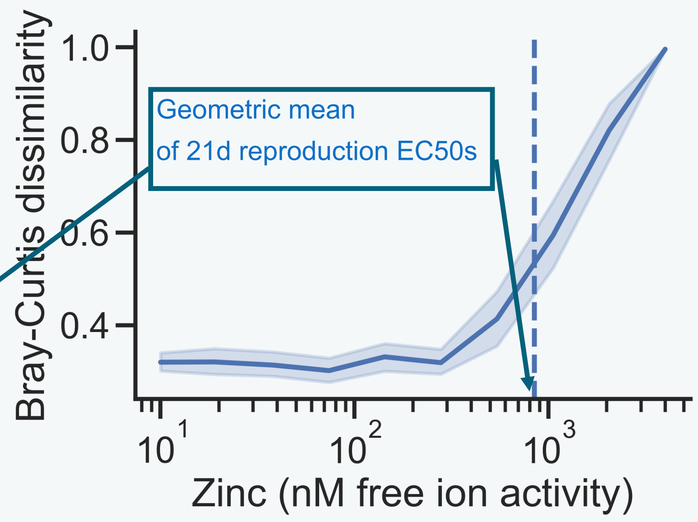
K_i = carrying capacity of species i

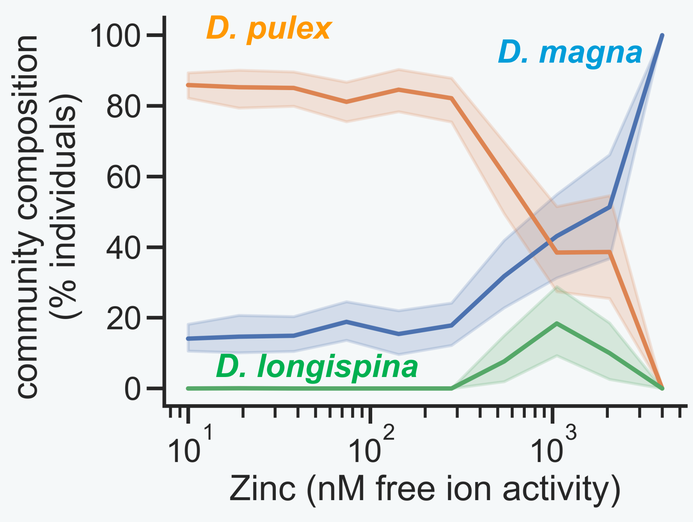
➡ Larger numbers = stronger interaction

	magna	*pulex*	*longispina*
magna	0	5.8	8.8
pulex	0.8	0	0
longispina	0.3	0.9	0

Predicted community response to Zinc







56d Productivity (total # Daphnids):
Less sensitive than 21d reproduction

Structure:
Equally sensitive as 21d reproduction

Composition:
shifts as a function of Zinc stress

Conclusions

1. **Low variability** in individual-level sensitivity of tested species

2. **Competitive and amensalistic dynamics** emerge from differences in physiological parameters.

3. Community sensitivity **different from** individual **sensitivity?**
—> structure: ~ equally sensitive
—> productivity: less sensitive

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Acknowledgments

This work is part of a project funded by the Flemish Research Foundation.

fwo Research Foundation Flanders Opening new horizons

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